Bellwork: 5/6/13

Simplify each expression:

1) $(2x^3y^2z)\cdot(3x^5y^2z^9)$

$6x^8y^4z^{10}$

2) $(3x^6yz^2)^3$

$27x^{18}y^3z^6$

$x^6 \cdot x^3$

x^9

$(x^6)^3$

x^{18}

$x^6 \cdot x^6 \cdot x^6$

Rational Exponents Notes

Objective: To evaluate expressions involving rational exponents.

$\sqrt{x} = x^{\frac{1}{2}}$

$\sqrt[3]{x} = x^{\frac{1}{3}}$

Definition of Rational Exponents: If b is a real number and n is a positive integer such that the principal nth root of b exists, then $b^{\frac{1}{n}}$ is defined to be

$\sqrt[3]{x} = x^{\frac{1}{3}}$ $\sqrt[3]{x^2} = x^{\frac{2}{3}}$ $b^{\frac{1}{n}} = \sqrt[n]{b}$.

$\sqrt[5]{5x^4y^3z^2}$

$5^{\frac{1}{5}} x^{\frac{4}{5}} y^{\frac{3}{5}} z^{\frac{2}{5}}$

Also, if m is a positive integer that has no common factor with n, then

$$b^{\frac{m}{n}} = \left(b^{\frac{1}{n}}\right)^m = \left(\sqrt[n]{b}\right)^m \quad \text{and} \quad b^{\frac{m}{n}} = \left(b^m\right)^{\frac{1}{n}} = \sqrt[n]{b^m}$$

$x^{\frac{3}{2}}$ $\left(x^{\frac{1}{2}}\right)^3 = \left(\sqrt{x}\right)^3$ or $\sqrt{x^3}$

The numerator of a rational exponent denotes the ***power*** to which the base is raised, and the denominator denotes the ***index*** or the ***root*** to be taken, as shown below.

$$b^{\frac{m}{n}} = \left(\sqrt[n]{b}\right)^m = \sqrt[n]{b^m}$$

(Power)

When working with rational exponents, the properties of integer exponents still apply.

Changing from Radical to Exponential Form:

1) $\sqrt[2]{3} = 3^{\frac{1}{2}}$

2) $\sqrt[2]{(3xy)^5} = (3xy)^{\frac{5}{2}}$

$3^{\frac{5}{2}} x^{\frac{5}{2}} y^{\frac{5}{2}}$

3) $\sqrt[4]{x^3} = x^{\frac{3}{4}}$

4) $x^2 \cdot \sqrt[3]{x} =$

$x^2 \cdot x^{\frac{1}{3}} = \boxed{x^{\frac{7}{3}}}$

Calc: $2+(1|3)$

Com. den: $\frac{2}{1} + \frac{1}{3}$

$\frac{6}{3} + \frac{1}{3} = \frac{7}{3}$

mixed #

$2\frac{1}{3} = \frac{7}{3}$

Changing from Exponential to Radical Form:

1) $x^{\frac{3}{5}} = \sqrt[5]{x^3}$

2) $7^{\frac{1}{4}} = \sqrt[4]{7}$

3) $2\boxed{x^{\frac{3}{4}} y^{\frac{1}{4}}} = 2\sqrt[4]{x^3 y}$

4) $\frac{a^{-\frac{3}{2}}}{1} = \frac{1}{a^{\frac{3}{2}}} = \frac{1}{\sqrt{a^3}}$

5) $x^{\frac{1}{3}} y^{\frac{1}{6}} =$

$x^{\frac{2}{6}} y^{\frac{1}{6}} = \sqrt[6]{x^2 y}$

Evaluating Expressions Involving Rational Exponents:

1) $27^{\frac{1}{3}} =$ $\sqrt[3]{27}$

$27 \wedge (1/3) = \boxed{3}$

2) $25^{\frac{3}{2}} =$ $\sqrt{25^3}$ or $\left(\sqrt{25}\right)^3$

$\boxed{125}$

3) $100^{\frac{-1}{2}} =$

$\frac{1}{100^{\frac{1}{2}}} = \frac{1}{\sqrt{100}}$

$= \boxed{\frac{1}{10}}$

4) $\left(\frac{16}{81}\right)^{\frac{1}{-4}} =$

$\frac{16^{-\frac{1}{4}}}{81^{-\frac{1}{4}}} = \frac{81^{\frac{1}{4}}}{16^{\frac{1}{4}}} = \frac{\sqrt[4]{81}}{\sqrt[4]{16}}$

$\boxed{\frac{3}{2}}$

Worksheet 1 - Rational Exponents

Express using rational exponents. get rid of $\sqrt{}$

1) $\sqrt[3]{5} =$

2) $\sqrt[5]{x^2} =$

3) $\sqrt[2]{c^1} = c^{\frac{1}{2}}$

4) $\sqrt[4]{3x^3} =$

5) $-\sqrt[5]{5^2} =$

6) $\sqrt{2x^3y^7} =$

Express in radical form. put in $\sqrt{}$

7) $x^{\frac{3}{5}} =$

8) $7^{\frac{2}{3}} =$

9) $m^{\frac{1}{6}}n^{\frac{5}{6}} =$

10) $11^{\frac{1}{2}} =$

11) $(3x)^{\frac{2}{7}}y^{\frac{5}{7}} =$

12) $13^{\frac{1}{4}}x^{\frac{3}{4}} =$

Evaluate each of the following.

13) $32^{\frac{1}{5}} =$

14) $\left(-\frac{1}{64}\right)^{\frac{1}{3}} =$ (-1/64)^(1/3)

15) $100^{\frac{3}{2}} =$

16) $243^{\frac{3}{5}} =$

17) $8^{\frac{5}{3}} =$

18) $-(144)^{\frac{1}{2}} =$ -(144)^(1/2)

19) $32^{\frac{3}{5}} =$

20) $\left(\frac{27}{8}\right)^{-\frac{1}{3}} =$

21) $\left(\frac{36}{25}\right)^{\frac{1}{2}} =$

22) $81^{\frac{1}{4}} =$